

Application No.: 10/820,024
Amendment under 37 CFR 1.111
Reply to Office Action dated August 15, 2008
February 17, 2009

AMENDMENTS TO THE CLAIMS

Please substitute the following claims for the pending claims with the same numbers respectively:

Claims 1-2 (Cancelled):

Claim 3 (Currently amended): A method for making a conductive electroless plated powder comprising the steps of:

(I) allowing core particles which have a noble metal ion-capturing ability to capture noble metal ions, and reducing the noble metal ions so that the surfaces of the core particles support the noble metal;

(II) ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions, a reducing agent, and a complexing agent comprising an amine to prepare an aqueous suspension, dispersing the core particles in the initial thin film-forming solution, and reducing the nickel ions to form initial thin nickel film on a surface of each of the core particles; and

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(III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, to the aqueous suspension individually and simultaneously, the aqueous suspension containing the core particles provided with the initial thin nickel films and the complexing agent to perform electroless plating so that columnar structures extending in a direction of a thickness of a nickel film are formed.

Claim 4 (Cancelled):

Claim 5 (Previously presented): The method according to claim 3, further comprising the step of using glycine or ethylenediamine as the complexing agent.

Claim 6 (Cancelled):

Claim 7 (Previously presented): The method according to claim 3, further comprising the step of providing, before said step (III), a ratio of the sum of the surface areas of the core particles contained in the aqueous suspension to the volume of the aqueous suspension between 0.1 to 15 m²/l.

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Claim 8 (Cancelled):

Claim 9 (Previously presented): The method according to claim 5, further comprising the step of providing, before said step (III), a ratio of the sum of the surface areas of the core particles contained in the aqueous suspension to the volume of the aqueous suspension between 0.1 to 15 m²/l.

Claim 10 (Previously presented): The method according to claim 3, further comprising the step of imparting the noble metal ion-capturing ability to the core particles by a surface treatment.

Claim 11 (Previously presented): The method according to claim 10, wherein said step of imparting the noble metal ion-capturing ability to the core particles by a surface treatment includes adjusting the amount of the surface treatment in the range between 0.3 and 100 mg/m² of the surface area of the core particles.

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Claim 12 (Currently amended): The method according to claim 3, wherein said step of (II) ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions, a reducing agent, and a complexing agent includes using glycine or ethylenediamine for the complexing agent; and

wherein said step of (III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, includes using glycine or ethylenediamine for the complexing agent.

Claim 13 (Previously presented): The method according to claim 3, wherein said step of adjusting the initial concentration of the complexing agent includes using glycine or ethylenediamine.

Claim 14 (Previously presented): The method according to claim 3, further comprising the step of providing, before said step of (III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second

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solution, which contains a reducing agent, a ratio of the sum of the surface areas of the core particles contained in the aqueous suspension to the volume of the aqueous suspension between 0.1 to 15 m²/l.

Claim 15 (Previously presented): The method according to claim 12, further comprising the step of providing, before said step of (III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, a ratio of the sum of the surface areas of the core particles contained in the aqueous suspension to the volume of the aqueous suspension between 0.1 to 15 m²/l.

Claim 16 (Currently amended): A method for making a conductive electroless plated powder including columnar structures extending in a direction of a thickness of a nickel film comprising the steps of:

(I) allowing the core particles which have a noble metal ion-capturing ability to capture noble metal ions, and reducing the noble metal ions so that the surfaces of the core particles support the noble metal;

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(II) dispersing the core particles in adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions, a reducing agent, and a complexing agent comprising an amine to prepare an aqueous suspension, dispersing the core particles in the initial thin film-forming solution, and reducing the nickel ions to form initial thin nickel film on a surface of each of the core particles;

(III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, to the aqueous suspension individually and simultaneously, the aqueous suspension containing the core particles provided with the initial thin nickel films and the complexing agent to perform electroless plating.

Claim 17 (Previously presented): The method according to claim 16, wherein said step of allowing core particles includes dispersing the core particles in a weakly acidic aqueous solution of a noble metal salt which is palladium chloride so that the noble metal ions are captured by the surfaces of the core particles.

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Claim 18 (Currently amended): The method according to claim 16, wherein said step of ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions includes forming an initial thin film in the range of the thickness between 0.001 and 2 μm .

Claim 19 (Currently amended): The method according to claim 18, wherein said step of ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions includes forming an initial thin film in the range of the thickness between 0.005 and 1 μm .

Claim 20 (Currently amended): The method according to claim 16, wherein said step of ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions includes adjusting the concentration of the nickel ions in the initial thin film-forming solution in the range between 2.0×10^{-4} and 1.0 mol/l.

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Claim 21 (Currently amended): The method according to claim 20, wherein said step of ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions includes adjusting the concentration of the nickel ions in the initial thin film-forming solution in the range between 1.0×10^{-3} and 0.1 mol/l.

Claim 22 (Currently amended): The method according to claim 16, wherein said step of ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions includes adjusting the reducing agent in the initial thin film-forming solution in the range between 4×10^{-4} and 2.0 mol/l.

Claim 23 (Currently amended): The method according to claim 22, wherein said step of ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions includes adjusting the reducing

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agent in the initial thin film-forming solution in the range between 2.0×10^{-3} and 0.2 mol/l.

Claim 24 (Currently amended): The method according to claim 16, wherein said step of ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions, a reducing agent, and a complexing agent includes using sodium borohydride or dimethylamine borane for the reducing agent.

Claim 25 (Currently amended): The method according to claim 16, wherein said step of ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing a complexing agent includes using glycine for the complexing agent; and

wherein said step of adding a nickel ion-containing solution containing the complexing agent includes using glycine for the complexing agent.

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Claim 26 (Previously presented): The method according to claim 37, wherein said step of adjusting the initial concentration of the complexing agent includes using glycine.

Claim 27 (Previously presented): The method according to claim 16, wherein said step of (III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, includes adjusting the concentration of the nickel ions in the nickel ion-containing solution in the range between 0.1 and 1.2 mol/l.

Claim 28 (Previously presented): The method according to claim 27, wherein said step of (III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, includes adjusting the concentration of the nickel ions in the nickel ion-containing solution in the range between 0.5 and 1.0 mol/l.

Claim 29 (Previously presented): The method according to claim 16, wherein said step of (III) adding a first solution,

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which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, includes adjusting the concentration of the reducing agent in the nickel ion-containing solution in the range between 0.1 and 20 mol/l.

Claim 30 (Previously presented): The method according to claim 29, wherein said step of (III) adding a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, includes adjusting the concentration of the reducing agent in the nickel ion-containing solution in the range between 1 and 10 mol/l.

Claim 31 (Previously presented): The method according to claim 16, wherein said step of (III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent-containing solution, includes adjusting the deposition rate of nickel between 1 and 10,000 nanometers/hour.

Claim 32 (Previously presented): The method according to claim 31, wherein said step of (III) adding a first solution,

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which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent-containing solution, includes adjusting the deposition rate of nickel between 5 and 300 nanometers/hour.

Claim 33 (Currently amended): A method for making a conductive electroless plated powder comprising the steps of:

(I) allowing the core particles which have a noble metal ion-capturing ability to capture noble metal ions, and reducing the noble metal ions so that the surfaces of the core particles support the noble metal;

(II) ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions, a reducing agent, and a complexing agent comprising an amine to prepare an aqueous suspension, dispersing the core particles in the initial thin film-forming solution, and reducing the nickel ions to form initial thin nickel film on a surface of each of the core particles;

(III) adding a first solution, which contains a nickel ion-containing solution containing and the complexing agent, and a second solution, which contains a reducing agent, to the aqueous

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suspension individually and simultaneously, the aqueous suspension containing the core particles provided with the initial thin nickel film and the complexing agent to perform electroless plating so that columnar structures extending in a direction of a thickness of a nickel film are formed; and

(IV) forming a gold plated layer as a top layer on the nickel film.

Claim 34 (Currently amended): A method for making a conductive electroless plated powder including columnar structures extending in a direction of a thickness of a nickel film comprising the steps of:

(I) allowing the core particles which have a noble metal ion-capturing ability to capture noble metal ions, and reducing the noble metal ions so that the surfaces of the core particles support the noble metal;

(II) ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing nickel ions, a reducing agent, and a complexing agent comprising an amine to prepare an aqueous suspension, dispersing the core particles in the initial thin film-forming solution, and

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reducing the nickel ions to form initial thin nickel film on a surface of each of the core particles;

(III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, to the aqueous suspension individually and simultaneously, the aqueous suspension containing the core particles provided with the initial thin nickel film and the complexing agent to perform electroless plating; and

(IV) forming a gold plated layer as a top layer on the nickel film.

Claim 35 (Previously presented): The method according to claim 3, further comprising at least one of the steps of:

adjusting the amounts of the nickel ion-containing solution added and the reducing agent-containing solution added;

adjusting the initial concentration of the complexing agent in the aqueous suspension; and

adjusting the concentration of the complexing agent in the nickel ion-containing solution, so as to maintain the concentration of the complexing agent in the aqueous suspension

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in the range of 0.003 to 10 moles/l in said step of (III) adding the first and second solutions.

Claim 36 (Previously presented): The method according to claim 16, further comprising the step of providing a ratio of the sum of the surface areas of the core particles contained in the aqueous suspension to the volume of the aqueous suspension between 0.1 to 15 m²/l.

Claim 37 (Previously presented): The method according to claim 16, further comprising at least one of the steps of:

adjusting the amounts of the nickel ion-containing solution added and the reducing agent-containing solution added;

adjusting the initial concentration of the complexing agent in the aqueous suspension; and

adjusting the concentration of the complexing agent in the nickel ion-containing solution, so as to maintain the concentration of the complexing agent in the aqueous suspension in the range of 0.003 to 10 moles/l in said step of adding the first and second solutions.

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Claim 38 (Previously presented): The method according to claim 34, further comprising the step of providing a ratio of the sum of the surface areas of the core particles contained in the aqueous suspension to the volume of the aqueous suspension between 0.1 to 15 m²/l.

Claim 39 (Previously presented): The method according to claim 34, further comprising at least one of the steps of:

adjusting the amounts of the nickel ion-containing solution added and the reducing agent-containing solution added;

adjusting the initial concentration of the complexing agent in the aqueous suspension; and

adjusting the concentration of the complexing agent in the nickel ion-containing solution, so as to maintain the concentration of the complexing agent in the aqueous suspension in the range of 0.003 to 10 moles/l in said step of adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent.

Claim 40 (Currently amended): A method for making a conductive electroless plated powder comprising the steps of:

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(I) allowing core particles which have a noble metal ion-capturing ability to capture noble metal ions, and reducing the noble metal ions so that the surfaces of the core particles support the noble metal;

(II) ~~dispersing the core particles in~~ adding a slurry, which includes the core particles prepared by said step of (I) allowing core particles, into an initial thin film-forming solution containing 1) nickel ions, 2) a reducing agent including one of sodium hypophosphite, sodium borohydride, potassium borohydride, dimethylamine borane, hydrazine and formalin, and 3) a complexing agent comprising an amine to prepare an aqueous suspension, dispersing the core particles in the initial thin film-forming solution, and wherein said step of dispersing the core particles in an initial thin film-forming solution containing nickel ions includes adjusting the reducing agent in the initial thin film-forming solution in the range between 4×10^{-4} and 2.0 mol/l so that the nickel ions are reduced to form initial thin nickel film on a surface of each of the core particles; and

(III) adding a first solution, which contains a nickel ion-containing solution and the complexing agent, and a second solution, which contains a reducing agent, to the aqueous suspension individually and simultaneously, the aqueous

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suspension containing the core particles provided with the initial thin nickel films and the complexing agent to perform electroless plating so that columnar structures extending in a direction of a thickness of a nickel film are formed.

Claim 41 (Previously presented): The method according to claim 40, wherein said step of dispersing the core particles in an initial thin film-forming solution containing nickel ions includes adjusting the reducing agent in the initial thin film-forming solution in the range between 2.0×10^{-3} and 0.2 mol/l.